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DOCUMENT-IDENTIFIER: US 6087135 A
TITLE: Modification of polysaccharides by means of a phenol oxidizing enzyme

Abstract Paragraph Left (1):
The present invention deals with a process for oxidation of a hydroxy group of C.sub.1 and/or C.sub.2 and/or C.sub.3 and/or C.sub.4 and/or C.sub.5 and/or C.sub.6 of a sugar monomer of an oligo- or a polysaccharide comprising contacting, in an aqueous medium, the oligo- or the polysaccharide with a phenol oxidizing enzyme and an enhancing agent, whereby an oligo- or a polysaccharide with altered characteristics compared to the native oligo- or polysaccharide is created.

Detailed Description Paragraph Right (31):
Based on this finding it is now possible to carry out chemical modification of oligo- or polysaccharides, fabric, yarn etc. containing soluble or insoluble polymer fibres, especially cellulosic fibres, by an enzymatic process in which a phenol oxidizing enzyme such as a peroxidase or a laccase, in combination with an enhancing agent, catalyzes the introduction of new functional groups in the oligo- or polysaccahride such as carbonyl groups and/or carboxylate groups.

Detailed Description Paragraph Right (34):
This enzymatically modified oligo- or polysaccharide is a good starting material for further modifications because carbonyl and carboxylate groups are reactive groups compared to hydroxy groups. Hereby textiles, fibres, yarns etc. with improved properties can be made. Examples of such properties are permanent press, softening, soil release, water repellancy and flame retardancy. The present invention provides a process by which, depending on the choice of conditions, (enzyme, enhancing agent, temperature, pH etc.) one or more of the desired properties may be obtained or improved in an easy, economical and environmentally friendly way. The wanted properties of the oligo- and polysaccharides will typically be achieved by further modifications, after the enzymatically oxidation according to the invention, by other means such as chemically and/or enzymatically modifications.

Detailed Description Paragraph Right (42):
Examples of suitable phenol oxidizing enzymes i.e. enzymes which act on aromatic compounds, in particular phenolic and/or polyphenolic compounds, are peroxidases (EC 1.11.1.7), laccases (EC 1.10.3.2), bilirubin oxidases (EC 1.3.3.5) monophenol monooxygenases (EC 1.14.18.1) and catechol oxidases (EC 1.10.3.1).

Detailed Description Paragraph Right (51):
Suitable laccase enzymes are known from microbial and plant origin. The microbial laccase enzyme may be derived from bacteria or fungi (including filamentous fungi and yeasts) and suitable examples include a laccase

Detailed Description Paragraph Right (52):
derivable from a strain of Aspergillus, Neurospora, e.g., N. crassa, Podospora, Botrytis, Collybia, Fomes, Lentinus, Pleurotus, Trametes, e.g., T. villosa and T. versicolor, Rhizoctonia, e.g., R. solani, Coprinus, e.g. C. plicatilis and C. cinereus, Psatyrella, Myceliophthora, e.g. M. thermophila, Scytalidium, Polyporus, e.g., P. pinsitus, Phlebia, e.g., P. radita (WO 92/01046), or Coriolus, e.g., C. hirsutus (JP 2-238885), in particular laccases obtainable from Trametes, Myceliophthora, Scytalidium or Polyporus.

Detailed Description Paragraph Right (67):
Further preferred mediators are oxoderivatives and N-hydroxy derivatives of

heterocyclic compounds and oximes of oxo- and formyl-derivatives of heterocyclic compounds, said heterocyclic compounds including five-membered nitrogen-containing heterocycles, in particular pyrrol, pyrazole and imidazole and their hydrogenated counterparts (e.g. pyrrolidine) as well as triazoles, such as 1,2,4-triazole; six-membered nitrogen-containing heterocycles, in particular mono-, di- and triazinanes (such as piperidine and piperazine), morpholine and their unsaturated counterparts (e.g. pyridine and pyrimidine); and condensed heterocycles containing the above heterocycles as substructures, e.g. indole, benzothiazole, quinoline and benzoazepine.

Detailed Description Paragraph Right (68):
Examples of preferred mediators from these classes of compounds are pyridine aldoximes; N-hydroxypyrrolidinediones such as N-hydroxysuccinimide and N-hydroxyphthalimide; 3,4-dihydro-3-hydroxybenzo[1,2,3]triazine-4-one; formaldoxime trimer (N,N',N"-trihydroxy-1,3,5-triazinane); and violuric acid (1,3-diazinane-2,4,5,6-tetrone-5-oxime).

Detailed Description Paragraph Right (70):
Preferred mediators are selected from the group consisting of 1-hydroxybenzotriazole; 1-hydroxybenzotriazole hydrate; 1-hydroxybenzotriazole sodium salt; 1-hydroxybenzotriazole potassium salt; 1-hydroxybenzotriazole lithium salt; 1-hydroxybenzotriazole ammonium salt; 1-hydroxybenzotriazole calcium salt; 1-hydroxybenzotriazole magnesium salt; and 1-hydroxybenzotriazole-6-sulphonic acid.

Detailed Description Paragraph Right (78):
Trametes villosa lacase (TvL) (previously called Polyporus pinsitus laccase) (obtainable from Novo Nordisk A/S).

Detailed Description Paragraph Left (6):
Laccases

CLAIMS:

1. A process for oxidation of a C.sub.1 and/or C.sub.2 and/or C.sub.3 and/or C.sub.4 and/or C.sub.5 and/or C.sub.6 hydroxy group of a sugar monomer of a starch, said process comprising contacting, in an aqueous medium, the starch with a laccase and an enhancing agent, under conditions in which said oxidation results in formation of a carbonyl or carboxylate group.

4. The process according to claim 1, wherein the laccase is obtainable from Trametes, Coprinus, or Myceliophthora.

5. The process according to claim 1, wherein the concentration of the laccase corresponds to 0.01-100 mg of enzyme protein per g of starch.